

**ADVISORY COMMITTEE  
ON THE  
FUTURE OF THE U.S. SPACE PROGRAM  
  
MINUTES  
  
SEPTEMBER 13-15, 1990  
WASHINGTON, D.C.**

(NASA-CR-190995) THE FIRST MEETING  
OF THE ADVISORY COMMITTEE ON THE  
FUTURE OF THE US SPACE PROGRAM  
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These minutes summarize the first meeting of the Advisory Committee on the Future of the U.S. Space Program (C-FUSSP) held in Washington DC, September 13-15, 1990. The minutes represent a summary of the major points made during the course of the three-day meeting. Attachment 1 includes the agenda for the meeting. Attachment 2 is a list of the committee members.

## **INTRODUCTION**

The meeting commenced with a welcome by the Committee Chairperson, Mr. Norman R. Augustine. During the introduction, the importance of input from the public was acknowledged and its continuation was encouraged. It was stated that this and future committee meetings would be open with a minimum number of meetings closed. With the exception of Committee Vice Chairperson Dr. Laurel Wilkening, whose input was provided to Mr. Augustine prior to the meeting, all committee members were present. The agenda was reviewed and the committee was told that the focus of the first meeting was to review the roles and responsibilities of both the National Space Council (NSpC) and NASA.

Augustine then reviewed the charter of the C-FUSSP and characterized the current effort as a broad, independent, and constructive approach where lessons from the past may help understand where NASA needs to go in the future. He stressed that the charter of the committee is to look toward the future and to advise the NASA Administrator on overall approaches that NASA management can use to implement the U.S. Space Program for the coming decades. Augustine stated the U.S. Space Program benefits from support of both the President and the Vice President, and that this impacts the importance of the committee's task. Augustine also stated that it is important to have input from the Congress and in support of this, he has spoken to, and will continue to speak with Congressional members on the efforts of this committee. One of his observations is that while the U.S. Space Program receives broad support from the public, no two people support the same space program.

Augustine concluded by stating that the tone of the meetings were not to be investigative, but informative and reflective with a high degree of interchange between individuals. Each presenter was instructed to allow one-half of their presentation for discussion of the information and that interruptions in the nature of questions were to be permitted, as appropriate.

## NATIONAL SPACE POLICY

The first presentation was by Mr. Mark Albrecht, Executive Secretary of the National Space Council (NSpC). Albrecht summarized the activities of the NSpC and its major roles and responsibilities. He stated that the NSpC membership was representative of all aspects of the space program, and he briefly reviewed the attributes and qualifications of the members.

On the role of the C-FUSSP, Albrecht was supportive and stated that the committee represented the opportunity to take a fresh look at everything the nation is doing in space, with a "no-holds barred approach." Albrecht referenced President Bush's support of the space program as evidenced by his first step of establishing the NSpC. The FY 91 budget request from the President is further evidence of his support and commitment. According to Albrecht, Bush met with Congress this past year to garnish support for the budget telling them to "think big and challenge the system."

The basic goals and guidance derived from National Space Policy demonstrates the Administration's commitment to U.S. leadership in space. According to Albrecht, such leadership strengthens national security, results in scientific and technology benefits for the general population, encourages private sector investment, promotes international cooperation, and expands human presence into space. The NSpC views the plan for exploring the solar system as one that is built on successes and envisions sustained operations ten years from now. The need, as stated by Albrecht, is to establish a solid foundation upon which to base this vision. Albrecht perceives the committee as one of the means by which to establish a strong foundation. The committee will provide a fresh look at future space activities, and according to Albrecht, this is what the Vice President believes the space program needs - an assessment to determine if we are on the right track, what we need to do to strengthen our programs, and to focus our goals and objectives.

The committee queried what the role of the NSpC was in setting national space goals. Albrecht stated that the NSpC provided coherence and continuity to the process. The NSpC functions to coordinate activities, facilitate decisions, and assist the Vice President and President in setting policy for space. Specific responsibilities include: establishing strategies; monitoring strategies; and, providing clarity to issues. The NSpC also gets involved at the interface level in different activities most notably with the Office of Management and Budget (OMB), the Office of Science and Technology (OST), and coordinates with other executive offices. While there is some overlap with NASA, Albrecht views this as an additive advantage. In response to a question concerning the relationship between NASA and the NSpC, Albrecht stated that the interactions with NASA are very important and that Admiral Truly is an integral member of the process. The process involves frequent formal and informal interactions. Albrecht communicates several times a week with Truly regarding issues, concerns and congressional questions. When asked a question concerning NSpC management responsibilities with regard to the space program, Albrecht informed the committee that the NSpC has no responsibility for managing any

aspect of the space program. The primary responsibility of the NSpC is to provide information to the Vice President. Essentially, NASA executes the missions, and the NSpC monitors performance.

The NSpC role in establishing policy for international cooperation was also discussed with particular reference to the Space Exploration Initiative (SEI). Albrecht stated that the NSpC provides the forum for dealing with international issues that include participation from the State Department and the National Security Council, as well as coordination with the White House. It is ultimately the President who has the authority to approve international cooperative efforts.

On the question of the NSpC staff, Albrecht informed the committee that there are 14 staff members assigned to the NSpC, seven of which are permanent and seven are detailees. According to Albrecht, the detailees strengthen the NSpC. The duration of the staff appointment to the council, or the tenure of each council member's appointment was not discussed.

The committee inquired about the distinction between establishing policy and its implementation. Albrecht stated that the internal management of Presidentially or Congressionally approved programs is strictly an internal NASA function, while the NSpC monitors policy. If the NSpC takes issue with a specific implementation of a policy, the NSpC would be kept apprised of the technical implementation, but would have no decision role. The line however, is not a sharp nor absolute one. For example, Albrecht stated that on some issues which have Presidential interest (e.g., NASP), the NSpC got more involved and monitored the budget levels to determine congruence with the President's guidance. On the other side, NASA participates actively in the formulation of policy.

The committee asked if the NSpC is the group that sets policy for the country and if so, how could the process be strengthened. Albrecht stated that the NSpC does function in this capacity, and the process is based on coordination with other agencies. There is no external advisory system in place at this time, although there is authorization for an advisory complement to the NSpC. According to Albrecht, the advisory system is not in place because of budget constraints. Albrecht would like to see an advisory board involved in the NSpC policy setting process rather than afterwards for an assessment. When asked about how much the NSpC consults with NASA on the establishment of policy, Albrecht stated that this is always done and coordinated through members of the council. Albrecht was also asked about the involvement of NASA in the SEI effort and he stated that NASA was involved both formally and informally. Many discussions were held between Albrecht and Truly long before the formal announcement to the President.

On the question of the role of the NSpC and Congress, the committee asked if Albrecht is required to testify before Congress. In reply, Albrecht informed the committee that he does not testify before Congress because the NSpC is part of the executive staff of the President. The NSpC functions to keep Congressional committees informed and advised. With regard to a question about testifying on

a voluntary basis before Congress, Albrecht stated that he has done so on an informal basis. In addition, he reported he has constant contact with Congressional staff members.

The committee then inquired about the costing process, specifically how the NSpC obtains sufficient data to determine the allocation of dollars for specific goals and objectives and the process for ensuring that such estimates are correct. Albrecht's response suggested that there was not an established process for accomplishing this. Albrecht stated that for broad efforts, such as the SEI, the dollars are hard to estimate. There is a top-level check to ensure that goals are consistent with what is technically feasible. On specific implementation strategies, cost data is obtained from OMB, OSTP, and other departments and agencies, with occasional input from the NAS and NRC. Albrecht concluded that some independent capability for costing would be valuable for the NSpC.

## **NASA ADMINISTRATOR OVERVIEW**

Admiral Richard H. Truly began his presentation with the acknowledgement of the committee's efforts to work on the problem of future NASA management. Admiral Truly presented an overview of NASA's organization, management philosophies, and approach. He began by stating that the National Space Policy and the Space Act of 1958 gives NASA broad authority to deal with the public openly, pursue international participation, involve the agency in manned and unmanned operations, and to pursue science and aeronautical research. Truly encouraged the committee to review the 1958 Space Act.

Truly then presented his view of U.S. leadership and the NASA Space Program. He stated that NASA's major goals are important to the leadership of the U.S. Thrusts in space science, aeronautical research, and exploration are important to obtain this leadership. To accomplish its goals, NASA must be capable, to be capable means having the people, facilities, and budgets to get the job done. Key programs include the space sciences, aeronautics, and technology. The aeronautical side is conducted hand-and-hand with industry and defense. The NASP represents a major endeavor for the agency. Truly was asked a question concerning the aeronautics budget, and the committee was told that aeronautics is an integral part of the program, representing approximately 10 percent (\$500 million plus \$100 million for NASP) of the budget. However, Truly informed the committee that budget tightening has hurt the aeronautics side of the house. A NASP management question was deferred for later in Admiral Truly's presentation.

In the area of exploration missions and technology, NASA is providing inputs to the SEI efforts, including the "synthesis" and "outreach" activities. Truly believes that there is a major role for development of space technology, even if SEI no longer existed.

The area of space operations is a growing one that includes on-orbit and Earth capabilities such as data tracking. In the area of space flight, NASA has

programs in STS, ELVs, SSF, and Spacelabs. Commercial space is an extremely important initiative. NASA currently has 16 Commercial Centers for the Development of Space (CCDS). The CCDSs are at U.S. universities and receive matching funds from industry. The objective of the CCDS concept is to seek out different market areas. There is also a major technology utilization effort, with NASA spending more time in this area than any other agency. Approximately \$25 million is spent on technology utilization. The third commercial area is in launch services, which is now a reality.

In a description of the NASA organization, Admiral Truly stressed that the organization is dynamic, and that in the last year and-a-half, two significant changes were made: combining the Office of Space Shuttle and the Office of Space Station under one Associate Administrator (AA), Dr. William Lenoir; and, reestablishing the Office of Exploration (OEXP) under the former Office of Aeronautics and Space Technology, and naming Arnold Aldrich as the AA. The former change was made to facilitate the integration, while the latter occurred because the technology needs for exploration best fit under that office and following that logic, OAST was renamed the Office of Aeronautics, Exploration and Technology (OAET). The committee was interested in understanding where the advanced planning activities were conducted since the reorganization. Truly stated that each program office has an advanced planning component that reports to the AAs, but that it is really dependent on the specific activity. Truly also initiated a program analysis activity in the Comptroller's Office. There was an inquiry whether there was an agency-wide process for analysis of innovative programs. Truly stated that historically, NASA has had a problem of too many things on its plate, it has never been a problem of getting new ideas. The systems engineering function, that goes along with an SEI endeavor, rests in the Office of Space Flight. The committee was told that a systems engineering and integration (SE&I) function was created at JSC for key science and engineering functions and has a very NASA-wide application. This function can either be powered-up or powered-down accordingly. It was stated that the question of preliminary design is one that the committee will want to examine in more detail. An inquiry was made about what group currently provides the Administrator of NASA with independent assessments of costs and schedules. Truly told the committee that there was none, but that the Comptroller's Office currently provides fiscal assessment of programs. Tommy Campbell, Administrator of the Comptroller's Office, stated that in 1980 a process was established to bring in a costing capability. This process involves utilizing individuals from the field centers who are not advocates of the program to review costs (i.e., the non-advocate review). This was in response to a previous problem that involved the lack of good in-house technical staffs to review the program. It was asked if CRAF-CASSINI went through such a process and the committee was told that all major and some minor initiatives are subject to this review of technical costs and schedules. In the case of CRAF-CASSINI, three reviews were held. This questioning was followed up with the observation that the science community was critical of the outcome of the de-scoping activity. The committee was told that the de-scoping was the result of external factors (e.g., Germany withdrew \$30 million in funding

due to reunification efforts). It was commented that this represents the enormous complexities involved in costing assessments.

The discussion then focused on questions about NASA personnel, specifically where NASA recruits its talent and the extent of turnover problems within the agency. The majority of the NASA staff comes from in-house with some of the senior positions filled by retiring military officers, aerospace industry, and DoD personnel. Truly stated that subsequent to Challenger, there was a high degree of turnover in senior positions (almost all have turned over). One of the problems for NASA in the recruitment of personnel for senior management is the difficulty of getting lengthy commitments from individuals. There was an inquiry regarding problems with attracting and retaining people because of salaries and the recent ethics constraints. Admiral Truly responded that the situation had stabilized. He stated that it was never a quantity problem, but rather quality. The committee was told that last year there were several resignations but that things were now stabilizing. There is however, a major problem in recruiting from academia and industry. It is difficult to get quality people to stay beyond a 3- to 4-year commitment. NASA was assigned the action to provide the committee with data on the background of previous AAs (for a 20-year period), including where they come from, their tenure with the agency, and where they go once they leave the agency.

Admiral Truly then went on to make two additional points: one concerning external advice and the second on center management. Truly stated that NASA takes pride in the role that external advice plays in assisting NASA. The problem being one of quantity - too much advice. Truly meets regularly with the Aerospace Advisory Panel and the NASA Advisory Council (NAC). Truly stated that the NAC currently consists of 25 individuals with 6 additional standing committees. Truly explained that NASA may not decide to act on all recommendations, but that it does listen to them. NASA management informed the committee that this process will continue.

On center management, Admiral Truly stated that there are essentially two organizational channels for reporting to the NASA Administrator. One reporting directly to the Administrator through a single person and the second reporting to the Administrator through the Program Office AA. Truly reported that the system is currently working, in fact, he stated that it works better than it ever has. Truly stated that there is a strong, but not unique relationship between centers and their respective AAs.

On program management responsibility, Truly stated that the AAs primary responsibility is to implement programs plus some additional institutional responsibilities. Centers have the responsibility for detailed quality execution of the programs. There are vertical lines directly to the centers, but the centers also have program execution and technical responsibility over the prime contractors. Truly convenes a General Management Status Review three times each month for 3 hours, with 1 hour dedicated to space operations, 1 hour for the AAs, and 1 hour for institutional (GMSR) review including center budgets,



people, and facilities. Additional meetings are held for special problems such as Hubble.

A specific question was asked on the management of the Space Station Freedom (SSF) Program Office. Admiral Truly responded that the Level III Program Office Director reports to the Center Director for budget and personnel but program direction starts from the Headquarter's AA, and it is a vertical program line. When Truly first became Administrator, there was a lead center concept which has now changed to a Program Director structure where only a single center is involved. The committee was told that there are about 490 civil service personnel in the Space Flight Office and that more than half (i.e., 300 to 350) are direct program staff, with the remainder looking at institutional responsibilities.

The discussion then focused on the interaction between NASA and other agencies. The committee inquired about how this function works. It was explained that this was functionally the responsibility of External Relations (Deputy Associate Administrator Peggy Finarelli), but depended upon the specific program and the AA as to the extent that other organizations get involved (e.g., NASP and ALS). The committee brought up the point that re-booking the manifest post-Challenger was particularly intense between NASA and DoD. Pre-Challenger was also intense, particularly on STS and ELVs. There was some discussion on the role of the NSpC and their participation in working out some of the interfaces, for example, in the case of NOAA or GOES. The committee was told that NASA keeps the NSpC informed, but Truly expressed the opinion that if he were to send the NSpC everything that is on the plate now no one would see the NSpC for the next 2 years.

The next discussion focused on the responsibilities of the centers. The observation was made by the committee that many of the centers' activities include science and engineering activities that are essentially in the same generic areas. The committee wanted to know how NASA manages and monitors the overlap and specifically, the management philosophy. Truly responded that in times of resource constraints this becomes very important, but by and large, there is not much duplication, and that the centers are doing different things in similar areas. (A point to be brought up later in the presentation.) During this discussion, it was emphasized that NASA tries to avoid duplicative efforts and that the study of field center science, chaired by committee member Jim Baker, did not find any significant overlap problems. Baker responded that the study did find that there are more programs than can be accommodated in terms of funding. It was stated that the Baker Study looked at the quality of the science and that in a resource constrained environment, this becomes a new issue. It is important to determine if ongoing work is consistent with the line of business one is directed to do. The committee was told that NASA should continue to build on the capabilities that the centers have developed over the years. It was responded that the tough decision is determining when to continue and when to terminate work. The discussion revealed that centers have limited autonomy in determining what new directions they may want to develop. It is based largely upon their own history and NASA

management monitors the direction of center work in terms of expanding into new areas. Centers do have the authority to terminate efforts at their own discretion (i.e., life support at the LaRC).

The Committee then asked a question on the reporting chain for JSC program people working on Dr. Fisk's programs. The committee was told that R&D dollars go through Fisk to JSC and that the Center Director Aaron Cohen is responsible to Dr. Fisk for the program. The institutional dollars at JSC go through the Office of Space Flight to Aaron Cohen. The committee inquired about the Hubble audit report, and Truly stated that if the committee required it, he would make it available.

The next discussion focused on facility and work force trends. Truly stated that almost every NASA program is now in its third generation of complexity. Most NASA facilities were built during Apollo and are in need of revamping. Most significantly, the workforce ratio needs to be corrected between the civil service and support contractors. During the past decade, there has been a leveling off of civil service personnel. On the contractor side, there has been a significant increase with a current ratio of 2 to 1. Truly stated that this trend is particularly noted in the erosion of people in civil service management positions.

Following the discussion on trends, Admiral Truly presented his view of NASA's strengths. These included NASA's strong role in fostering U.S. leadership, enhancing quality education, developing and training scientists and engineers, and supporting unique facilities. Foremost among NASA's strengths is its long record of contributing to the national goals of U.S. leadership. NASA has also always played a strong role in contributing to the nation's educational goals, with a growing potential for further positive impact on the education of the nation's children. Admiral Truly is strongly committed to continuing NASA's educational efforts. Among NASA's strengths, Truly acknowledged that NASA has a highly skilled and capable work force. He added that the problem regarding NASA personnel is not in terms of quality, that it never has been, but rather a problem of quantity. Truly also stressed the unique facilities, including laboratories and wind tunnels, that contribute to quality science and technology development. Truly also referred to the tradition of teamwork that characterizes the relationships between NASA and other government agencies, industry, and universities. In addition, open and visible programs, a way of life for NASA, are tough to do. The openness, however, provides a strength that enriches the agency. Truly also viewed the advisory committee process as a NASA strength; NASA believes in the importance of these relationships and always strives to listen to committee recommendations. Finally, Truly stated that NASA's strength is also derived from public support and that currently, there is wide support from the public for the space program. A question was raised by the committee about the results of a recent survey on public support of NASA. The committee replied that there was a survey conducted by private industry and the results revealed widespread support for NASA. The committee requested a copy of the results of the survey.

Admiral Truly then summarized his major concerns for the space program and stated that one major concern is the need to maximize and invigorate NASA's capabilities. According to Truly, the means for so doing lie in having strong management authority. Admiral Truly stated that the organization that runs space must have the authority to do so and that it is not just a matter of accountability and responsibility; budget authority is essential. Truly's second concern involved the need to assure robust space transportation. Truly stated that having a strong space transportation program is a national goal. Currently NASA is deciding whether another orbiter is required, when a follow-on to STS will be needed, whether a heavy-lift launch vehicle is needed for SEI, and determining the international and commercial applications. Truly advocated the need for the U.S. to continue to lead in space launch capabilities. The third concern regarded Space Station Freedom (SSF). NASA has to decide if its feasible, maintainable, and affordable. According to Truly, the SSF is on schedule for the PDR, but that there are current concerns about the EVA, maintenance, weight, and power. These issues are currently being addressed within NASA. Truly also emphasized that the lack of fiscal authority is an important concern. There is a problem in obtaining appropriate resources to match the programs which need to be undertaken. Another concern focused on the autonomy of management decisions. Admiral Truly would like to enable better government management practices. For example, more authority to move dollars around, with the provision that it does not conflict with goals and objectives, would facilitate the efficiency and effectiveness of NASA operations.

The next area discussed by Admiral Truly focused on his vision for the year 2000. According to Truly, SEI would be underway, the Mission to Planet Earth would be ongoing, the SSF would be operational, and the Great Observatories would be in orbit and operating. Truly envisions a capable NASA institution at the core and a space program that leads the world in achievements and in vision. The committee Pete Aldridge inquired how much such a program would cost. The committee was told that it would be somewhere at two times the cost of the current NASA.

Brief comments by the committee at the conclusion of Admiral Truly's presentation demonstrated support for his vision. The committee stated that the envisioned program was not an unrealistic or unreasonable one, nor was it unaffordable. During the Apollo days, the NASA budget was 4.3 percent of the GNP; today it is only 1 percent. One of the questions asked by the committee was how to go about ramping up for such an undertaking. Admiral Truly deferred this discussion until later during the other presentations.

## **OFFICE OF SPACE SCIENCE AND APPLICATIONS**

Dr. Fisk, Associate Administrator (AA) for the Office of Space Science and Applications (OSSA), began his presentation with a preamble of what was to be presented. Fisk would address what OSSA is doing and how OSSA manages its programs and plans for the next decade - focusing on Mission to Planet Earth. Fisk stated that the goal of the OSSA was to conduct science by using the unique vantage point and environment of space to expand knowledge of the

universe, to understand the factors that influence the Earth's environment, and to solve practical problems on Earth. Fisk told the committee that NASA is judged by its science, therefore the science community is very important to the process. The payoff is in terms of accomplishing the science and conducting the observations. Dr. Fisk stated that NASA is also judged in part on the accessibility of data to the scientific community. Dr. Fisk commented that one of the major changes in the past 10 years is that today we can choose the means by which to do the science.

Dr. Fisk then discussed each of the seven disciplines that are most readily accomplished in space. The disciplines include astrophysics, space physics, solar system exploration, Earth science (e.g., providing a systematic global perspective), life science (e.g., understanding living in space and ground spin-offs), microgravity (e.g., how do fluids and materials respond to space), and communications (e.g., advanced communications satellites). The committee asked about the applications issue, specifically what does solving practical problems on Earth really mean. According to Dr. Fisk, the list is ordered in terms of the increasing utility of findings for each discipline, particularly the potential for spin-offs on a short-time scale. There are more immediate payoffs for communications, microgravity and life science than for astrophysics, space physics and solar system exploration. Fisk stated that an inventory of his program reveals that for the 1990's, there are some 35 to 40 missions scheduled in the next 4 to 6 years with as many as 7 in any one year. This is contrasted to the 1980's when missions were launched only 11 times.

The committee asked about what was driving the orientation to larger missions instead of smaller missions. The question was asked how much of this trend reflects external pressure and how much of it is actually driven by the science. Fisk replied that missions are established in response to the science community, and that there is a mechanical situation that drives new starts. NASA gets one new start a year; it is difficult to get two new starts in any one year. He stated that OSSA has a strategic planning process in place now that it prioritizes OSSA missions. There are both moderate and major new starts which require one-half a billion dollars and up; small programs do not require new starts. The goal is to have a line item program where you do not have to ask for a new start. A question was raised on what percentage of a mission is international in terms of cost and participation. There was not really a definite answer for this question, but the 10 percent range was quoted. The committee requested that the history of the percentage of the budget that was allocated for R&D dollars be made available to the committee. An issue was raised concerning the number of scientists that would require funding to support the Earth Science Program and the availability of funding. It was stated by the committee that there may be an obligation to support these scientists in the future. Fisk explained that the R&A budget needs to be analyzed for more than just dollars. There are 8500 OSSA scientists with a considerable number at the universities (3500). The university community has all of the same problems as NASA in terms of aging facilities.

Fisk then described the OSSA strategic planning and budgeting cycle. The committee stated that this process is influenced by technology development and that this was an understated but important driver in the process. Fisk stated that the strategic planning effort has been successful and that today's plans focus on three areas: Mission to Planet Earth; Space Exploration, and the Core Program.

The committee inquired about the cost containment plan and the extent to which the best judgements were being made. Fisk replied that OSSA has 100 standing committees that advise OSSA with regard to their programs. The committees range from Principal Investigators in science working groups to the National Academy's Space Science Board. In addition, according to Fisk, at any given time, there are probably 1000 scientists actively participating in the program.

The next discussion focused on the management of the research base, a base that Dr. Fisk referred to as changing in terms of the number of grants funded and the amount of funding per grant. One of the issues involved the grant process. The committee stated that the dollars for grants vary across disciplines, and that the size and the total number of individual grants overall is decreasing. One of the consequences concerns the use of the PIs time. Scientists are currently writing more proposals to get sufficient support from NASA. As an example, each PI submits four grants per year, since the current ratio is one out of three get funded. The committee emphasized that the problem is further confounded among the planetary scientists who are not usually tenured faculty and depend upon NASA for funding which requires proposals. The committee added that a benefit of the SEI effort is its potential to provide the long-term funding that is needed for science programs. Another related issue was the number of scientists who would be available to do the work. It was mentioned that SSF would require 200 microgravity scientists to do the science; currently there are only 100.

In a discussion of the SEI, Fisk emphasized the importance of the life sciences research and the robotic sciences. According to Dr. Fisk, the OSSA roles for the SEI are natural extensions of its Core Program elements. Life sciences builds upon SSF and utilizes explorer-class satellites for radiation biology. Robotic exploration supports parallel scientific studies and collection of precursor data for mission designers, and in-situ science capitalizes on unique opportunities provided by Lunar and Mars exploration. Fisk emphasized that OSSA will proceed at a pace that matches that of both NASA and the nation.

The Mission to Planet Earth (MPE) represents a combination of new programs. The long-term goal is to determine how the Earth responds to human interventions. Fisk stressed that this is a program that is driven by science; not real estate. The committee questioned the feasibility of using smaller satellites to accomplish the objectives, so that all is not lost by dependence on the large components. Fisk stated that when Mission to Planet Earth is broken into component parts, it is essentially an extension of what we are already doing in flight hardware.

Summarizing his presentation, Dr. Fisk stated that the execution of the Core Program, the Mission to Planet Earth, and the SEI will require a substantial growth in funding and in the work force. He stated that there are initial plans for these programs, and that the processes are basically in place. Dr. Fisk believes that the OSSA budget has to double from 28 million in the next five years to accomplish these objectives.

The committee asked about the feasibility of transitioning some programs, such as EOS, to another agency. Fisk replied that scientific understanding is the goal, and that NASA is the only agency that builds spacecraft, other than the DoD. He stated that NASA can not go on indefinitely flying spacecraft and that if NASA did not break out of this responsibility soon, there would be no SEI. The committee questioned some of these costs in relation to the health of NASA. The committee stated that STS is largely undertaken to conduct science. The ratio of the user to the infrastructure is approximately 20 percent. Admiral Truly stated that Congress views the 20 percent as an entitlement, and that the percentage of allocations is a poor way to look at the management structure. The committee was told that the issue is important for the future; the inflexibility of the 20 percent is a barrier. Fisk emphasized that the 20 percent may be an artifact of the past and with the onset of the present initiatives, it may change.

## **OFFICE OF SPACE FLIGHT**

The next presentation was by Dr. William B. Lenoir, Associate Administrator for Space Flight. Lenoir organized his presentation to provide information on what the Office of Space Flight (OSF) has done, what it currently is doing, and what options exist for the future. In the current environment there is an ongoing transition toward buying commercial services for ELVs. Current effort is focused on Spacelabs, satellite servicing, and SSF planning. The future includes international launch capabilities and an evolving SSF. The OSF manages the STS, SSF, and future services. OSF also procures commercial launch services, which is in a transition phase where NASA is 80 percent there. TDRSS and Ulysses are on STS flights because it is most cost effective now. In the future NASA will move to ELVs through commercial procurement. Dr. Lenoir views the management of the SSF with all the international interfaces as one of the major challenges for the next 12 years.

The committee asked about the relationship between the Program Director and the Center Director. The committee was told that in the case of a disagreement, the AAs would discuss the problem. The observation was made by the committee, that the program manager does not have direct responsibility over some of the centers that do the work for him, and the committee wanted to better understand the effects of this. The committee also asked if there was a cost assessment problem, would the administrator be immediately informed. The committee was told that this would be the case.

On the question of an advanced planning function for the OSF, Lenoir told the committee that currently there was none. He stressed that he would like an

independent assessment function to examine requirements. He stated as an example that the ACRV should serve a limited number of requirements.

On the issue of personnel resources, Lenoir stated that NASA is currently trying to enrich its Headquarters engineering base and analytic capabilities. Lenoir felt that this was an area that needed improvement. He told the committee that he is trying to bring in the skills of a senior engineer to become Chief Engineer for OSF. One of the problems is that the individuals at Reston are SSF people. At JSC there is a talent of engineers to draw upon that are not assigned to STS. There is a need now to try to bring in the right people. Industry is going in the opposite direction and NASA is turning too many young engineers into bureaucrats and engineers that end up too expensive for NASA to afford. They quickly go back into industry when the opportunity avails. NASA needs engineers to do bench level engineering and to do systems engineering. Lenoir stated that NASA currently contracts out too much of its engineering work.

In terms of programs, Lenoir views the 1993/1994 timeframe as critical for decisions about the STS and SSF program operations. The committee inquired about where an ALS program would be conducted and Lenoir stated at the MSFC.

The process for decision making was also discussed and Lenoir described the functions of the Management Council. These are monthly executive sessions that can also include prime contractors. Post-Challenger criticism targeted a lack of communication within the agency; the onset of the management council was a means to communicate more effectively. Two weeks ago, the Management Council was brought together for an all-day meeting on reducing the Shuttle costs. Admiral Truly stated that Bill Lenoir was moving in the direction of getting near-interchangability between Center Directors and their Deputies. A question was asked by the committee why Program Directors do not have a seat on the Council and Lenoir stated that he has wrestled with the problem but doesn't know the answer. At the present time, depending on the issue, he does include them. Program reviews and quarterly meetings are more open; the project management staff is present for the review of the program.

In terms of budget approval, Lenoir stated that prioritization and budget constraints led him to cancel the OMV program, thus shifting priorities within the OSF. Lenoir stated that currently he is working three different budgets: the FY1991, FY1992 and this year's budgets.

The committee inquired about Lenoir's organizational philosophy with regard to a multi-agency program such as SSF; specifically how dollars are passed from the Program Office to the Center. Lenoir stated that it goes through the Program Managers to the Center Directors with the Center very involved. The issue is a balance of power between Centers and Headquarters. Truly stated that he believes the process is working, better now than previously. Post-Challenger, the shift was toward project responsibility at the Center. The committee was told

that in STS the communications across the program are working very well. Lenoir stated that his plan is to continue to modify the organization based on what people do. Deputy Administrator Truly emphasized that when he was in charge two weeks after the Challenger, Headquarters was perceived as weak for many reasons. The change was to create a Program Director and then it evolved into the current structure. JR Thompson stated that he thought NASA may be going too much in this direction and that a little more balance has to be achieved between Headquarters and the Centers. Truly stressed the importance of having the responsibility, authority, and accountability to do the job. The committee brought up a concern over SSF organization. Specifically, that NASA is moving away from the authority of the Program Manager, which is different from industry and the DoD. The committee stated that the comparison of the NASA Program Manager to the DoD Program Manager is not accurate. The DoD manager has less power than his NASA counterpart.

There was some discussion of the problem from the Center's perspective on having to be responsible to two bosses. On one hand there is a responsibility to the Center Director, and on the other to the Program Director. The committee was told that this problem is unavoidable and alternatives are limited. The committee questioned the complex relationship between the program manager at Level III who reports to Level II. It was decided that several members of the committee would get together with Admiral Truly to further understand this relationship.

Another SSF question was asked regarding the role of Grumman; the committee was told that Grumman will transition from a support organization to a systems engineering and integration organization. The challenges confronting SSF include funding adequacy and stability, requirements control, integration complexity, system verification planning, and international operations.

In a discussion of challenges, Lenoir stated that they include assuring robust space transportation, reducing operating costs, maintaining corporate knowledge, and developing options for the next generation vehicles. He reported that controlling labor costs is a problem across the board and there is a need to operate more efficiently. Maintaining corporate knowledge is also a concern. There is a need to be able to hand this off to the next generation. Another concern involves operating at the margins which is embedded in assuring robust space transportation.

The next discussion focused on the utilization of SSF. The committee expressed a concern with having the materials people on board to support the SSF. The concern was whether NASA spends as much on material sciences as the NSF. The committee inquired about the number of flights per year. Dr. Lenoir stated that for the first year there are 5 flights for assembly followed by logistics, crew rotation, etc., all of which are dependent on the pace of the SSF after the first element launch. The committee inquired about the use of Shuttle C and was told that the gain is small and would require a redesign of the SSF. Lenoir was asked if SSF supports the SEI. He responded in the affirmative.



The committee asked if there was any documentation of the requirements for material and life sciences research and that it is important to ask the science community what they want. The committee made the point that at least 50 percent to 70 percent of the research community needs to be on-board with SSF. Several members of the committee stated the need for an objective study of the requirements for both life and material sciences that would demonstrate the status of the requirements and what is feasible. The committee requested that a one-page fact sheet on costs for the SSF be prepared.

## **SPACE OPERATIONS**

The second day of the meetings began with a presentation by Charles Force, Associate Administrator for the Office of Space Operations (OSO). The presentation was organized to provide information on the functions, facilities, management structure, accomplishments, and challenges confronting OSO.

On the issue of personnel, Force reported that a very small cadre of people were required to support OSO relative to the size of the budget. Headquarters has 61 civil servants and 26 support service contractors. The primary reason for this is that OSO conducts most of its work through the Centers and does not have any institutional responsibilities. The committee inquired why the name of the office had changed. The committee was told that this occurred under Dr. Fletcher in 1987 when Stan Phillips recommended the change as part of his management study to the Administrator. While the name changed, the roles and missions remained the same.

Force told the committee that the nation's space programs are dependent on three critical components: the spacecraft; the space transportation systems; and, the operations, communications, tracking and data processing that are the responsibility of the OSO. Force made the important point that solutions to real-time space mission anomalies are often limited to the capability and flexibility of OSO networks. According to Force, mission success is possible only when all three elements meet their performance requirements. Key characteristics of the OSO include: a multi-mission approach; emphasis upon continuity of operations; requirements for technology advances in communications control and data systems; and requirements for continuous interactions with other program offices from conceptual phase through mission completion.

The principle activities of this office include spacecraft operations and control centers, ground and space communications, data acquisition and processing, flight dynamics and trajectory analyses, spacecraft tracking, and applied research and development of new technology. The role of the OSO and TDRSS was discussed. The committee was told that OSO owns, operates, and is responsible for maintaining it. The committee asked about how much data is obtained by TDRS and how much of the data is actually used. Al Diaz, Deputy Associate Administrator for OSSA, referred to a GAO study and stated that on the first order almost 100 percent of the data is used but after that there is insufficient R&D funds for full data utilization. The dollars essentially go to collecting of data and not for analysis. Diaz's perception was that this was an

example of the traditional debate over how resources should be allocated between acquisition systems or analysis efforts. The committee inquired about the international data satellites and was told that both Japan and ESA are working on TDRSS-type vehicles and there is a trilateral working group resolving interoperability problems.

A chart, presented by Force, on the number of spacecraft operated indicated an almost doubling of spacecraft from 1990 (i.e., 9 spacecraft) to 1994 (i.e., 17 spacecraft.) One of the messages of the chart is the continued operation of "old" spacecraft. For example, NIMBUS was launched in 1978 and will continue to be a reliable and useful source of data regarding the ozone layer, well into the 1990's.

In a review of the budget history for the OSO, Force stated that the budget has remained fairly constant at approximately 7 percent to 8 percent of the NASA budget per year. The high peaks during the 1980's reflect the higher interest rates during the off-budget financing activity for TDRSS. Force commented that the nature of OSO work is manpower intensive and the FY 91 budget request revealed a total budget of \$889 million and a contractor manpower number of 5508.

In the discussion of OSO facilities, Force showed a chart that revealed a complex network of near-Earth, deep space, ground control, and data tracking, capture and processing facilities. The committee asked if TDRSS was now fully operational and how many ground stations existed for deep space use. Force informed the committee that TDRSS is fully operational and that many of the ground control stations were eliminated. The committee commented that NASA had done an excellent job of shutting down control centers once TDRSS went into full operation. The committee asked about the extent to which TDRSS was unique and Force stated that all facilities are now multi-functional and multi-purposeful. According to Force, the addition or elimination of a single satellite would have little budgetary impact. One of the committee members raised a concern about the trading time capacity of the deep space network. Force stated that the problem is one of having adequate antennae in the long term, but for the short term, international partnerships were being utilized. According to the committee, one of the concerns of the research community is that NASA is not able to track all their numerous spacecraft, especially in a resource constrained environment. The committee asked how this problem could be fixed and the extent to which the international resources were used to alleviate some of the cost burden. The committee stated that it will look into the question of cost, worth and demand. The committee also inquired about the existence of cooperative tracking arrangements with the Soviets. Force told the committee that the U.S.S.R. has excellent antennae; but in terms of reciprocity, an insufficient number of satellites for the U.S. to track.

The longevity of spacecraft systems was also discussed. The committee asked about the aging of the systems and Force stated that NASA has been reasonably successful in upgrading its facilities. The committee was told that the approach to operations is to maximize the return on resources. NASA is

driven out of some systems by lack of replacement parts. The committee inquired about a long-range planning function. Force told the committee that the OSO has a strategic plan and an advanced planning function. Force is concerned that fundamental systems trades will have to be made for SEI. The committee asked about who is responsible for paying for any changes and was told that both OSO and the relevant program pays.

The committee discussed some of the funding patterns concerning the OSO and commented that the emphasis on the hill has been more on getting programs initiated and continued than in getting data back from existing and planned satellites. It was revealed to the committee that the OSO has had a tradition of getting hits from the Congress. Both the Congress and OMB have the perception that the requirements of the OSO can be decreased or slipped. The committee expressed the opinion that data relay operations are as important as getting into space and that this needs to be supported early and strongly.

On a discussion of the capabilities and the capacity that is needed, Force stated that major capabilities have been the result of OSO initiation. For example, the upgrade in the 64-meter DSN to 70-meter. Upgrades are responsive to specific mission needs. The committee stated that the research community was an integral part of the process to upgrade the capabilities. The committee was told that the capacity is utilized by prioritizing the users' needs, and that low priority users' needs are not fully accommodated. The committee stated that it is important to establish the capabilities for the future, since individuals design to the capabilities that exist and then crunches come later in capacity when over-subscription takes place.

The next discussion focused on the acceptance of risk on satellite replenishment. Force told the committee that NASA uses a 20 percent need probability for TDRSS spacecraft replenishment planning. This is based on statistical projection of spacecraft lifetime and launch risk. Force stated that the approach is consistent with the DoD aerospace model. DoD uses a 10 percent need probability for replenishment. Commercial satellite operations uses 20 percent and buys 5 satellites for every 4 that are needed.

The accomplishments and strengths of the OSO was discussed next. Force told the committee that in 1968 the network provided coverage for approximately 15 percent of the time. The upgrade to TDRSS brought this up to 80 percent. Force emphasized that this is an area which demonstrates world leadership - only the U.S. operates in the outer solar system. There was a request to get an article by Cooper (June 90) in the New Yorker on the sociology of U.S.S.R. and Soviet problems in space. The committee was told that the U.S. has provided support for 17 foreign spacecraft during the past 2 years. The U.S. standards are now adopted as world standards, and the U.S. leads the world in this technology.

On the discussion of "success secrets," Force stated that it is early and continuous interaction with users that leads to the successful accomplishment of

mission objectives with minimum life cycle cost. Force emphasized that this is particularly important in terms of the requirements. The pathway to success is also a function of maintaining specialized expertise and operations discipline - which Force views as key to success. In addition, flexibility is required to accommodate dynamic requirements. Success is also dependent upon a multi-mission infrastructure for efficiency, the ability to capitalize on advanced technologies, and the cooperative efforts in terms of using similar infrastructures of other agencies and nations.

The major challenges facing the OSO are primarily budget instabilities, federal acquisition regulations, incorporating advanced technology while meeting operational requirements, attaining and maintaining a balanced civil service work force, and maintaining the OSO infrastructure while accommodating new and changing requirements. The committee inquired about the cost of standard deviation of budget fluctuation. Baker asserted that a level budget is better than a fluctuating one and asked what low but level budget amount would be preferable to the mean level of the fluctuating budget. The ensuing discussion revealed that it is difficult to determine which is better - a fluctuating budget or a lower but constant level. In the area of space operations, cost predictions are fairly reliable and it is an unknown whether it is better to live with a low level of constant funding to avoid replanning. The committee was told that the problem of level funding for constant programs is an issue across the agency. Once NASA proceeds down the road to build something, you can not stop, or slow down; it will increase the budget. The committee wanted to know how much of the budget fluctuation problem is caused by NASA, OMB, and Congress. The answer was that it is hard to accurately estimate external actions. A comment was made by the committee that the budget fluctuation issue has a major impact on morale.

On near-term challenges, Force explained that there are three major challenges: follow-on tracking and data relay satellite, the SSF and EOS requirements, and the SEI. The first challenge involves an evolution that accommodates spacecraft replenishment, an increase in system reliability and lifetime, and increased commercial launch services with on-orbit delivery. SSF and the EOS will require a 100-fold increase in data, and there will be a need to accommodate dynamic requirements. In terms of SEI, Force stated that there are large differences between the Moon and Mars operations and the use of planetary relay satellites. The committee inquired why these are near-term challenges. Force reported that the next five-year period is considered near-term because of the planning and decisions that are required to enable the long-term planning activities. The committee stated that advanced technology is a driver of spacecraft instruments, and that the advanced technology capability for tracking satellites will be important for future mission options. The committee stated that total cost will always be a driver for large, highly reliable, multi-purpose spacecraft, at a cost of flexibility in operations. The committee stated that the Authorization and Appropriation Committees has been fairly benevolent to OSO in the past, although there is usually a push toward reduction. Congress doesn't fully understand everything that OSO is trying to do. (In fact it was stated that tracking and data is the least understood issue on

the hill, including the science that can be obtained.) The end result was that Congress would try to squeeze a little more. The committee stated that the instability was due more to OMB than to Congress. The committee added that while Congress is last to look at the budget, the management of NASA must also be held responsible. A request was made to NASA to obtain an historical plot (30 years) of the OMB budget submittal versus the Congressional budget submittal versus the appropriations.

Further discussion of the budget patterns for the OSO lead to the following observations by the committee. Previous Congressional committee membership was more stable and the subject matter was better understood because individuals would grow to learn their subjects better. It was stated that the space program as a whole was also more strongly supported by the public than it is now. This influenced the Congress. It was also stated that predictability of the budget must be preceded by confidence in the cost estimates. The committee concluded that many of the individuals do not realize the value of the OSO in supporting other agencies and that there are major benefits in terms of strengthening these interfaces.

## **OFFICE OF AERONAUTICS, EXPLORATION, AND TECHNOLOGY**

The next presentation was made by Arnold Aldrich, Associate Administrator for the Office of Aeronautics, Exploration, and Technology (OAET). Aldrich began his presentation with a statement of the mission of the OAET which is to provide research and technology to continue U.S. pre-eminence in aeronautics, to enhance current and enable future space missions, and conduct exploration program planning and initial implementation. Aldrich stated that the budget issue for OAET is different than it is for OSO. Technology is wanted now, but what happens after it gets started is something different. The programs stretch out and get decremented which effects morale.

Aldrich stated that the key program areas were aeronautics, the National Aerospace Plane (NASP), space technology, and space exploration. Institutional responsibilities included ARC, LaRC and LeRC. The organization of OAET includes a Deputy Associate Administrator, a Chief Engineer, an Assistant Associate Administrator for Exploration, a Special Assistant, and a Special Assistant for Exploration. OAET also has a management council comprised of Center Directors from ARC, LaRC, and LeRC. New to the organization is the Director of Space Exploration and establishing the leader of NASP as a full Program Director. Aldrich told the committee that the OAET divisions are matrixed to other programs.

Budget information for FY 90 was presented and programmatic development and advocacy was discussed. The five stages for this include identifying opportunities, development of technology plans, internal and external reviews and advocacy at the agency, and OMB and Congressional levels as part of the budget cycle. Programmatic management and implementation includes the following process: receiving funds from the Administrator in the five program areas; the directorates are responsible for program direction and balance;

discipline divisions are responsible for program management; are the Centers are responsible for program implementation. Headquarter's management conducts frequent informal technical reviews. There are also monthly general management status reviews, periodic reviews of major projects, annual reviews of plans, progress and accomplishments, and occasional broad program assessments.

On the aeronautics side of the house, Aldrich stated that the charter was established in 1915 with NACA and continues to the present, 75 years later. The committee asked about the interaction with the FAA and Aldrich reported that is well established and coordinated with NASA's aeronautics program.

In terms of aviation leadership, Aldrich told the committee that the stakes are high. Aviation is a significant contributor to the national economy with sales exceeding \$90 billion year and over 1 million employees. Aviation provides a vital domestic and international infrastructure and is critical for national defense. According to Aldrich NASA aeronautics is well-coordinated with the DoD. In the area of international competition, Aldrich revealed some significant trends. The U.S. share of the transportation market has decreased from 90 percent in the 1970's to 70 percent in the 1990's. The supersonic transport area is receiving large dollars from the Japanese market, and the European market is investing in the subsonic area. Aldrich reviewed the six strategic thrusts of the OAET aeronautics program: subsonic aircraft, high-speed air transportation, high-performance military aircraft, hypersonic transatmospheric vehicles, critical disciplines, and national facilities.

In a review of the FY 91 budget request, Aldrich was asked how the resource allocation is derived. Aldrich informed the committee that budget allocation is conducted through a process involving advisory committees. The committee asked if the 10 percent for universities was historically consistent and Aldrich informed the committee that in the last several years this was true. Aldrich reported that the trend regarding funding is downward, and that there is a need for more advocacy in aeronautics. Several new initiatives have been proposed for FY 92. One of the issues is that there still remains a problem of insufficient visibility for the aeronautics program and that it competes with SEI and EOS. The committee asked if there is much support for aeronautics R&D from the OMB. Aldrich stated that in contrast to the Reagan years, the support is good. Both Aldrich and Truly stated that they are trying to increase the visibility for aeronautics.

Aldrich then discussed NASA's aeronautical capabilities. These include wind tunnels, simulation and human factors facilities, and theoretical and computer simulations. The committee asked if the computer fluid dynamics (CFD) would ever replace the wind tunnels. Aldrich stated that they are complementary and that the wind tunnels are required to validate the CFD. The strengths and weaknesses of the aeronautics program were discussed and Aldrich stated that among the strengths are unique people and facilities, an effective strategy to guide the program, and strong effective relationships with industry, universities, and with other government agencies. Some of the weaknesses include a

limited focused technology development and validation for transition to industry application, constrained investment in aging and new major facilities, expanded use of contractor services for research and facility operations, and low public visibility.

In the area of high performance computing initiative, Aldrich stated that the goal is to achieve a 1000-fold increase in computing capabilities. The requirements for NASA in this area are significant and include computational capabilities that address huge challenges that are essential to achieving NASA's missions. Aldrich believes that high-performance computing is vital to NASA, parallel-computing systems are essential, and that major benefits can be accrued from NASA being a key participant in the federal program.

The next area discussed was the NASP. Aldrich told the committee that the NASP program is now in an advanced position due to the teaming efforts of the contractors and the National Space Council review. The committee asked where the payoff in NASP was and Aldrich stated it was in the air breather to upper atmosphere. The committee was told that the NASP was an advanced Shuttle. The committee stated that the difficulty in getting support for the NASP was in the lack of a clear definition of a user. Truly added that it is too soon to say that it will replace STS, but that the payoffs are so great, NASA has to move forward on it. The committee stated that part of the problem was that it was oversold to begin with. A comment was made by the committee that both the NAC and the DSB advisories suggested that the NASP could be looked at for upper stages on conventional chemical rockets and wanted to know if this was being considered. The committee was told that a group at LaRC was examining this. The committee expressed some concern that there was a lack of attention to the two advisory reports (NAC and DSB) on space transportation. NASA Deputy Administrator J.R. Thompson added that NASP focus has remained on single stage to orbit. The committee stated that one of the NASP's benefits was for orbital plane changes and that this flexibility would have tremendous applications. The committee stated that the options should be kept open, but that it would be important to understand why NASP is needed. A concern was also expressed by the committee about the international competition in civil aviation and that both ALS and NASP needed to be supported. Truly added that both the civil transport and the NASP made the budget cuts. The committee stated that it may be important to determine priorities since both can not be undertaken on a shoestring budget. A concern was raised about long-term costs and that short-term decision parameters needed to be specified. Truly stated that the NASP program today is a better program as a result of all the debates.

In the area of space technology, Aldrich stated that the goals were to develop and validate technology, to increase mission safety and reliability, reduce mission development operations and costs, enhance mission performance, and enable new missions. Major thrusts in this area include transportation, science, SSF, and exploration. The committee stated that the NAC criticism about NASA's space technology was that NASA is not doing in space technology what it is doing in aeronautics. The committee was told that this subject is being

discussed, but the budget just will not support it and that NASA is under pressure to support the commercial launch area.

The committee was told that exploration technology will be a big effort and will outpace and overcome other space technology activities in the future. The committee commented on the disappointing support from Congress on Pathfinder funding. Aldrich told the committee that it was basically a problem of process. The budget presented to Congress hides what NASA is really doing in the technology areas and the curve is on the downside. The problem is that there has to be a start-up for SEI. The new dollars will not be available until 1992 and what was originally a 5-year initiative is now a 7-year program. Pathfinder was a program that was advocated but never supported. Congress tends to squeeze the technology programs, and one of the problems is that NASA does not find out about this until late in the budget cycle. As a consequence, the researchers at the centers have to replan and downscope original proposals. A great deal of time and effort is expended to develop the plans. The committee stated that this is also a problem for the researchers who have to keep readjusting and that it is a critical problem for the program. The committee stated that it effected the recruitment and the maintenance of a good base of people.

The next portion of the OAET presentation focused on the space exploration program. Aldrich briefly reviewed the history leading up to NASA's 90-day study on human exploration of the Moon and Mars. He told the committee that the study consisted of analysis, not recommendations. The report summarizes trade studies, but is not a definitive program plan. In reviewing the conclusions of the study, Aldrich reported that there were major investments in challenging areas of technologies, that the scientific considerations are considerable, robotic spacecraft are required, current launch capabilities are inadequate, SSF is essential, program alternatives do not exist, there are numerous opportunities for international cooperation, and that a long-range commitment of resources is essential.

The committee inquired about NASA's involvement with other federal agencies such as DoD and DOE. Aldrich stated that Admiral Truly is very involved in developing the interfaces and there is currently a NASA-DOE Memo of Understanding (MOU), but that nothing as specific had been developed with the DoD. Aldrich believes that the 7 critical technologies listed in the 90-day study are still valid. The budget for SEI was briefly discussed and the committee was told that the technology program for supporting SEI was at one-half billion per year. FY 92 was the first shot to plan the SEI budget and that the curve ramps up sharply in 1993 and 1994. The committee asked if a 30-year projection was available, and that they were interested in the interaction between cost and technology pace. Specifically, how one decides when there is value to a slow paced program and when each technology has to be ramped up for contribution to SEI. The committee referred to the Stafford study (i.e., the "Synthesis" Group) that will determine what is required for SEI. Stafford's group is looking at alternatives. The committee inquired as to the extent of support in Congress for the SEI and Truly responded that there is not a negative attitude. Truly



mentioned that he thought there was an acute sense of putting SEI off until the nation's economic problems are put in better order. The committee stated that the Congress is not yet ready to sign up for it and cautioned NASA against misreading the signals - a little study money does not correlate to Congressional commitment to a program. It was also mentioned by the committee, that Congress will view this as an international program. There was a concern expressed by the committee that some caution should be taken regarding cooperation and the dependency it can foster between international programs. An action was taken to make available the NAS review of NASA's 90-day study.

## **NASA PERSONNEL AND INSTITUTION**

Sam Keller, Associate Deputy Administrator, presented a review of the NASA institution addressing what it is, what are the major problems, and what NASA is doing about them. Keller began with a review of the major components of NASA's infrastructure and its unique facilities. According to Keller, the major questions concerning the management structure include centralized, delegated management, the role of the staff functions, the relationship between authority and responsibility, line management's accountability, and what type of structure works. A comparison of organizational charts was presented from 1974, 1980, and 1990. The committee was told that currently NASA is creating a line management structure with dollars going to the AAs and then to the Center Directors. Under the current structure, the person who is responsible for executing the program is also responsible for the Center. Keller stated that in the implementation of a line management organization, a span of control of four individuals (AAs) is not unreasonable. In this system, each level is held accountable for accomplishment of its objectives. The staff function is to advise management of anticipated problems and report on agency performance against established criteria.

Keller then described the budget structure for the agency and stated that there were four separate appropriations: R&D, SFCDC, C of F, and R&PM. Problems included budget lead time, score keeping, maintaining programmatic balance, reprogramming constraints, and annual nature of appropriations. The committee raised the question of length of funding and was told that the length of R&D funding is for two years. The committee also inquired about how NASA was able to get all replacement orbiter money in one appropriation. They were told that Congress and OMB made it happen, but it was a different climate at the time.

Keller stated that to move money around requires an appropriations bill and there are many restrictions on shifting categories around. In the three levels of R&PM dollars, Keller observed that the agency had not done a very good job. The committee raised a question on how one goes about conducting a 30-year program a year at a time? The committee was also told that a change in schedule (either way - slowing up or accelerating) will impact the budget.

The committee asked about the costs for launches and if payloads are considered and were told that for new start programs, the AAs do not consider launch costs. The committee then inquired about who actually decides on use of the ELV or STS and was told that the OSF assigns the flights.

A question related to quality control was raised, specifically about the potential of avoiding the Hubble Telescope problem if 100 individuals had been in the plant. Keller responded that the probability for detecting it would have been much higher.

In the area of budgeting for new projects, Keller stated that the AAs are responsible for the entire budget and that the budget includes dollars, people, and facilities. The budget includes all agency elements with assignments for project responsibilities. The current philosophy of the agency is not to take on new work without adequate resources.

Keller next addressed manpower limitation concerns and stated a general belief that the agency is controlled by controlling manpower. After Apollo, the agency was reduced from 35,000 to 21,000. Currently the trend is toward containing government and contracting services out. NASA contracts out 85 percent of appropriated funds. There is confusion over the role of prime and support contractors. Keller emphasized an important point just what should NASA's role be? A program agency? On the agency's part, there appears to be a reluctance to state manpower requirements for new projects. According to Keller, this reflects a belief that dollars can be sold to Congress but not the manpower necessary to protect the investment. The committee asked why support contractors were negatively viewed and was told that legally there are restrictions on the employer-employee relationship. These restrictions build in a separation that adds to the problem. Keller also emphasized again what does the nation want? A contracted space agency, or a space agency? The committee inquired about how in this type of environment can one recruit and retain good quality people? Truly responded that he felt the problem was at the margins and the inappropriate use of contractors. Fink stated that the problem may be in the restrictions and regulations. The process of procuring support contractors may have driven down the costs and the quality. The committee also commented on the controlled management philosophy of NASA versus the Air Force. There is more use of primes in the Air Force as well as other alternatives such as MITRE. The committee stated that it would look into this issue further. Keller emphasized the point that someone has to decide what role NASA should be in. The legalities regarding the civil service versus the subcontractor relationship effects the in-house capability of NASA. The committee was told that the trend regarding manpower ratios went from a 1:1 ratio between civil service and contractors to a 2:1 ratio, within a 3-year period. The committee was told that one consequence is that the program managers are getting very innovative in obtaining a work force.

In discussing concerns with the work force, Keller stated that there has to be sufficient amount of in-house work for the young engineers and scientists for purposes of training. The rationale for work force increases include several

inadequacies in personnel resources: an inadequate number of procurement professionals; an inadequate staff to perform systems review and quality assurance; and an inadequate staff to perform research to develop requirements. There was a discussion of the problem of providing training opportunities for the work force and that NASA routinely competes with industry in this area. In addition, there are problems concerning costs for relocation and recruitment as well as travel limitations that can become professional strangulation for the science staff. The committee requested the actual numbers for this information and a list of the backgrounds of the previous AAs.

In the area of efficient management and procurement constraints, Keller stated that defensive contracting now makes the process overly time consuming and that the trend is now towards the mediocre rather than the best. The committee asked if this could be better controlled with the authority of the Space Act. The committee commented that the problem in government contracting is the antithesis of the movement toward TQM. The committee noted that one of the problems is the lack of extended multi-year funding.

The next discussion focused on the management of the Centers in terms of their roles and missions. Keller told the committee that they are now looking more carefully at project assignments and that there is value to be gained from some competition between Centers. The committee expressed a concern that there may not be a critical mass at the Centers where similar activities are going on for healthy competition. There was also a discussion on the use of GOCO laboratory operations. On the positive side, it was viewed as providing flexibility, quick response times, and recruitment advantages. On the negative, it tends to drain talent from the central agency and can be non-responsive to direction. Truly commented that the institutions are as important as the programs and that the agency needs flexibility in this area.

The committee commented that the management philosophy of the space program may not be appropriate for the SEI. The committee stated that if you can not take on programs because you do not have the resources, you may have to change the way you do business. Keller emphasized that it is important to separate the program manager from the researchers. This led to a discussion about contracting out of certain operations such as launches. Keller inquired about how much of space operations do you want to contract out? J.R. Thompson asked what would be the value of spinning-off the Shuttle? The committee asked NASA how much time it spends in operations and was told that it is considerable. The committee responded that this takes time away from forward-looking programs such as SEI. Truly stated that NASA is serious about taking responsibility for STS and that this was a major criticism of the Rogers Report. Truly told the committee that NASA is now managing the program and satisfied with it. It was stated, by a committee member, that the NASA Administration will always be responsible for the STS and that you could not spin it off. Truly stated that the organization is dynamic and the Administrator of the agency has to have the authority and responsibility for the launches.

## **ROUNDTABLE DISCUSSION**

At the end of the first day of the three-day meeting, the committee asked Keller what he would do if he were unconstrained. Keller responded that he would encourage a simplification in procedures, make individuals more accountable for results, and provide for flexibility. In terms of the budget, Keller also stated that he would like the system to be more flexible and more accountable. He would also like to be able to assemble a work force in the same fashion as industry does.

The committee was also told that if they wanted, Assistant Deputy Administrator O'Brien would provide a copy of the impediments chapter he had assembled for the 90-day study, particularly the background information he had assembled.

The meeting concluded with a review of what information was needed for the next meeting on September 28 and 29 with the Center Directors. The committee informed NASA that they wanted more quantitative data on budgets and costs.

## **DISCUSSIONS OF FUTURE PERSPECTIVES OF THE U.S. SPACE PROGRAM BASED ON SELECTED PAST STUDIES**

On Saturday, September 15 the Committee on the Future of the U.S. Space Program was scheduled to hear summaries from the primary authors of four reports related to the future of the U.S. Space Program. Summaries of the reports were prepared and forwarded to the committee members prior to the meeting. The reports included: Pioneering the Space Frontier, presented to the C-FUSSP by the Chairperson of the National Commission on Space study, Dr. Thomas O. Paine; Leadership and America's Future in Space, presented by Alan Ladwig; Toward a New Era in Space: Realigning Policies to New Realities, presented by Dr. Robert S. Cooper; and A More Effective Civil Space Program: The Final Report of the CSIS Study of Civil Space Policy, presented by James R. Morrison. All four authors of the reports had been asked to speak to the committee about their perspective of events that had transpired since their studies and what they perceived as some of the major barriers, as well as solutions to the future success of NASA's space program.

### **National Commission on Space - Dr. Tom Paine**

The first speaker was committee member Dr. Thomas O. Paine. Dr. Paine began with an explanation of the origin of his study. He told the C-FUSSP that the major difference between the National Commission on Space and the C-FUSSP was sponsorship. He stated that discussions with Congressman Dan Fuqua had led to the idea of a National Commission on Space. NASA Administrator Beggs had advocated many different types of long-range plans. The National Commission on Space was established in 1985 to pursue a vision that looked toward a 20-year horizon for the future of space. It was added that at the time, there were many plans, but that NASA Administration was

constrained from presenting them because this might put the nation's Administration in a problematic situation.

Tom Paine explained that pictures were used as the primary means for transmitting the information in the report to maximize the interest of the public. The imagined point of reference for the report was the year 2035. According to Paine, experience had demonstrated that the 1935 to the 1985 perspective would have been too narrow and would have failed to highlight economic and technical advances.

One of the critical assumptions of the study group was that the peak space budget would be one-half that of the Apollo era, and that became the assumed resource base for the study. The study also assumed that at the conclusion of the 21st century, people would be able to travel the inner solar system including missions to nearby asteroids, the Moon and to Mars. The report also assumed adequate Heavy Lift Launch Vehicles for Low-Earth Orbit. The study group also formed a major premise that sprint missions would be subordinate to development of infrastructure. Paine reported that specific milestones were presented in the report with a Mars landing in the year 2015. Paine pointed out that both the opening statement of the report and the closing statement are essentially the same: "To lead the exploration and development of the space frontier, advancing science, technology, and enterprise, and building institutions and systems that make accessible vast new resources and support human settlements beyond Earth orbit, from the highlands of the Moon to the plains of Mars."

The committee inquired as to whether or not Congress had endorsed the report and was told by Tom Paine that everybody had claimed to like it, but no money was forthcoming. One of the funding barriers was the Challenger incident, which occurred in the middle of the report. Another funding barrier was an underestimation of operating costs specifically, the 1990 projection of NASA's budget was less than it actually turned out to be because of unforeseen Shuttle expenses, SSF expenses, and SSF delays. The committee stated that the report can be criticized because it was wrong in estimating costs and time requirements. The point was made, how do we correct for these problems now? In the current environment, micromanagement has created program instability. The committee made the statement that we can go to the Moon for \$75 billion (current Apollo dollars). The barriers for going to Mars are Galactic Cosmic Radiation, shielding requirements, and long-duration weightlessness problems. The Lunar Outpost would provide a learning period to counteract some of these problems (e.g., long-duration reduced gravity effects.) The committee stated that Congress never really examined the study in any detail. The committee commented on the environment during the Apollo era. During Apollo the space program had significantly more money, but there was also a war, hunger, and perhaps even more destitute conditions than today. The question was asked what is the difference? The committee speculated that there was public support for the space program and that the primary reason for the success for the space program was the leadership of John F. Kennedy. The committee added that another important factor was the threat of the space race with the U.S.S.R. and

a nuclear war. The committee stated that the former era of military power, as the most important characteristic of world leadership, is on the decline. Today, it is economic power, and if the U.S. does not go forward with space exploration, Japan will.

The committee commented that in today's environment the same challenges exist as they did when the NCOS developed their report, except that they are of a slightly different complexion now. The committee inquired as to whether Paine had seen the development of any unforeseen technology advances since the NCOS report. Paine responded in the negative. In further considering the problems of the NCOS report, the committee stated that the assumptions of technical and economic feasibility were incorrect. Economic feasibility may not be possible today. Paine replied that the NCOS report included several failures of assumptions. He stated that the JPL model was not considered as an alternative because in its early days JPL quality was notoriously poor.

The committee pursued the questioning about the NCOS report with an inquiry about why the nation seemed more resilient to failures in the earlier days. In actuality, there were as many editorial cartoons and negative news reels about NASA, yet the contrast between the Apollo 13 fire and the Challenger incident resulted in delays in the space program that varied from only a few months after Apollo and several years after Challenger. Truly stated that this premise is wrong and that the process of recovery was really very similar for the two events. Paine stated that during Challenger, NASA did not have strong leadership which caused much of the problem. The committee added that the risks with the manned, as well as the unmanned programs, are large. How can leadership really make the difference? The committee stated that the difference is in clear, well-articulated, well-understood, and agreed upon goals. This is hard to accomplish. The committee added that it is difficult to put the Apollo 13 fire in the same category as Challenger, but that one thing was clear - the next program must have the built-in resilience and determination to carry-on in times of failure.

### **NASA Leadership and America's Future in Space - Alan Ladwig**

The next speaker was Alan Ladwig, the former Director of Special Projects for the Office of Exploration. Ladwig introduced himself by saying that for him space was a dream and not a career. He left NASA because of burnout after spending ten years with the agency. During his tenure at NASA, he was manager of several programs and was assigned to Dr. Sally Ride's study team to help prepare the analysis of initiatives and goals for NASA Administrator Dr. Fletcher. Ladwig stated that he left NASA because of his frustration with the promotion system and SES constraints. He stated that he was awarded two awards for exceptional service but was never able to obtain SES status. He recommended that the committee talk to the mid-career level personnel at the Centers. Ladwig also stated that during the course of the study, the Center personnel that worked on the study perceived that they worked for NASA - not for the Center.

In reviewing the Ride Report, he told the committee that the report was developed after the Paine Report and that it was an attempt to blend vision with reality. The environment for the report was post-Challenger, NASA was undergoing a strategic planning exercise, numerous other studies were underway (e.g., NASA Life Sciences Strategic Planning Study, NASA Mixed Fleet Study, NAC Space Science Crisis, etc.), and there was a National Space Policy Review in 1982. The Leadership Task Force was established in September 1986. The charter of the Task Force was to define potential U.S. space initiatives, evaluate them in light of the current program, and with regard to the nation's desire to regain leadership. The objectives of the study were to energize discussion of long-range goals and investigate strategies to direct program leadership. The intent of the report was not to select one goal, but to facilitate discussion and to understand the requirements.

Ladwig then reviewed the process by which the Ride Report was conducted. The staff was assigned to Code A and consisted of three professional, 1 clerical, and contractor support. Four candidate initiatives were selected (i.e., Mission to Planet Earth, Exploration for Solar System, Outpost on the Moon, and Humans to Mars.) A special advocate study group was assigned to each initiative and a special group on strategic planning was formed. Each of the initiatives were analyzed, specific schedules and scenarios were developed, requirements in terms of technology, transportation, orbital facilities, and precursors were defined, and assumptions were clarified with regard to STS manifest and SSF capabilities. The study guidelines did not permit conducting an open cost assessment of the initiatives. This was primarily because of the sticker shock over the Paine Report.

The key issues of the report included: Earth-to-orbit as the most pressing issue; rebuilding of technology base was essential; life sciences research needed to be pursued vigorously; the impact on SSF evolution needed to be understood; and it was critical to establish the Office of Exploration. Ladwig commented that the nation is not serious about developing the technology that is required for such bold goals. He stated that during the mid-1980's the climate was such that one could not talk about a Moon-Mars initiative. It was this that led to the discussion to establish an Exploration Office.

The report concluded that it was not necessary to lead in all areas. That leadership requirements included the capability to act independently, goals which inspired others, active demonstration of capabilities, identification of priorities, and building and maintaining resources. Ladwig stated that "bold initiatives" start with today's capabilities.

In a critique of the study, Ladwig stated that the report was deficient in that it did not recommend one single goal. When the Office of Exploration was formed, it did not include the Mission to Planet Earth or Solar System Exploration. At the end of the study, there was discussion of not releasing the report and no press conference was held when the report was finished. A last negative sign was that there were insufficient copies for wide distribution (Ladwig recommended that the C-FUSSP have plenty of copied made.) Ladwig also made the

observation that the Congressional staffers have too much power and influence in the system.

The legacy of the Ride Report was discussed and Ladwig shared with the committee that there had been numerous news clippings and many references to the study in subsequent reports. The Office of Exploration was established and the development of the scenarios were further developed (i.e., NASA's 90-Day Study of the Moon and Mars.) Ladwig stated that the report raised the visibility of the issues. There was a subsequent annual report from the Exploration Office in 1988 (i.e., Beyond the Earth's Boundaries) and the Strategic Planning Task Group continued to meet. The leadership phase analysis was not continued. Ladwig stated that there was excitement throughout the agency in the young personnel at the time.

Ladwig reflected on the differences in the cultures that existed in time of Apollo and the current environment. Ladwig recommended that the committee read Fred Kuminoff's publication, "Energy the Enabler." Ladwig also stated that the agency needs to do a better job on presentation, and that information to the public needs to be more refined.

Ladwig offered the committee several observations regarding the educational aspects. First he stated that there is no study on the correlation of space program careers and technical education. Second there is a need to disseminate widely, information related to the science and engineering doctorates from this agency.

On a philosophical note, Ladwig compared space to an ocean, not a lake, and questioned why the Mission to Planet Earth should have to compete with an exploration initiative for funding. Ladwig recommended more coverage of the space program on television and in particular, the proceedings of the committee. He also cautioned against the "rush to do studies," burning people out and then doing nothing. He also asked when do new people get a chance at the advisory committees?

The committee asked what had happened to the Strategic Planning Task Group and Ladwig commented that they have gone back to pursuing their jobs. The committee was told that these individuals were never full time, that it was an *ad hoc* activity. The JSC people (strategic planning people) are apparently still in the network and the committee was told that Admiral Truly is trying to improve the situation.

The committee asked about why the media coverage has been so negative and was told that the media wanted to see a better track record, but that this was a no-win game. Paine stated that Congress had requested that NASA respond to the NCOS study and Ladwig stated that NASA's response was rather pathetic. The committee suggested that the public becomes familiar with the problems through the media and they become skeptical. This skepticism is reflected in Congress. "Its tough to worry hydrogen leaks and the future at the same time." The committee further commented that the research community has had 15



years of Shuttle and the forecast of its access to space. They also have become skeptics. He asked the committee how we can get rid of baggage of promises not delivered? The response was that it is a vicious burn-out cycle. The committee stated that a lot of science has been conducted in the last few years.

The committee stated that Ladwig's presentation lacked substance and wanted to know from Ladwig what should be done to remedy the problems. Ladwig did not offer any solutions, stating that he had not been asked to talk about that and referred to Keller's presentation from the previous day that also addressed the problems but held no solutions. Truly stated that part of the solution was to provide hiring authority at the Centers. Ladwig stated that we should ask why we have not been able to sell Mars. The committee responded that the "Synthesis Group" is a review body and that the real work is being done by young and bright people. The committee referred to the SEI goal itself; that it is a 30-year goal and how can such a long-term goal be sustained? One suggestion was to break it into smaller components. A comment was made by the committee that the space program itself is only 33 years old and one has to realize that it is not a personal affront if we do not get to Mars in our lifetime. Ladwig commented that there is something wrong, that we have to have this big goal out there in order to be contributors. The committee stated that there are questions about a dual ladder program - if they exist and if they are successful. The discussion ended after a few more comments on the subject.

#### **National Academy of Sciences/National Academy of Engineering Review - Bob Cooper**

The next speaker of the afternoon was Bob Cooper who reviewed the NAS/NAE Report entitled, "Toward a New Era in Space." The major points of Cooper's presentation included integration of the science community with the whole space program, the role of the SSF, funding, center management, personnel advancement barriers, procurement system restrictions, and leadership. Each of these areas is further elaborated in the description of Cooper's presentation to the C-FUSSP as discussed below.

Cooper began his presentation by stating that the concerns of the Academy at the time the report was prepared (1988) were focused on three areas: space policy, aids, and disaster in transportation. The report was prepared as a white paper that was addressed to President George Bush, and focused on future of space policies within the realities of the present environment. Cooper described the participants in the study and stated that they represented a wide spectrum of beliefs with regard to the new era of space. The study committee was also concerned that NASA was not up to the task of the big combined program. Cooper emphasized that it was important to convince the space science community that they needed to identify with and be part of the whole space program. In the final analysis, Cooper stated that the science community wanted the science work split off and protected from the huge, manned program. Cooper recommended that the entire report be read to get the whole gist of what was recommended.

The NAS/NAE committee adopted the position that humans would reach out into the universe and a white paper addressed to President Bush by Frank Press, President of the National Academy of Sciences, and Robert White, President of the National Academy of Engineering, endorsed human exploration. One of the key issues in the report was the Space Station Freedom (SSF) role. The report recommended that the SSF should be optimized to perform research in the life sciences in preparation for long-duration missions. The committee suggested that this implied a limited role for the SSF as a transportation node and Cooper agreed. He stated that the rationale to support this position was that it would make it easier to obtain and retain funding. He also reported that the ESA and Japanese modules would address the other areas. The committee also addressed the goal of the space program and supported the Moon-Mars initiative, but put it into a longer time frame (i.e., 50 years) and recommended that the U.S. focus on needed technology development in the interim.

The committee inquired if the study group had discussions on the alternative missions and Cooper told the committee that they did not address alternatives. The belief was that the Moon-Mars initiative was inevitable and the committee's task was to undertake what was necessary to get the most out of it for the scientific community. Cooper stated that the group examined far-reaching technologies such as reconnaissance probes to near-by stars. On the issue of funding, Cooper reported that the level should be approximately \$10 billion for a base program with STS serving as a truck. Cooper believed that it would be necessary to bring NASA's budget up by about \$3 billion per year to support each of the initiatives for a total of \$9 billion. NASA currently has one-half of the required dollars to support the three initiatives (\$4.5 billion) and has promised a great deal for the dollars. It was suggested to NASA that dollars be re-appropriated from other programs to support the science programs. The C-FUSSP referred to another NAS study referenced in the Stever Report and requested that the committee obtain this report. Cooper told the committee that the discussions among the group regarding the international relations lead to a recommendation concerning specific programs that the other nations could take the lead in. The group also concluded that the relationship between DoD, National Security, and Civil Space was not good and recommended a General Officer be brought into the Administrator's Office. The group also recommended making the field centers private and associating them with universities like JPL-Cal Tech.

In a discussion of the capability of the SES system, the committee asked if the group's examination of the SES system revealed problems. Cooper stated that the SES system is a small veneer, that you have to be able to get the best out of the schools, retain them for 5 to 7 years, then select the best for retention and advancement, while replacing others to create space for new people. The committee asked if the Center scientists are impeded if they do not take on management positions and Cooper stated that there are only a few S&T positions of higher grades because of resource limitations. The committee commented that we have to figure out ways to reward the S&T people. Truly stated that he has spent a great deal of time on this problem. Cooper reflected

on the observation that people in general feel that the system is broken, that NASA can not get the right people or can not move them around; the recommendation is for NASA to go fix the system. Truly stated that the systems disciplines should be rotated between Headquarters and the Centers, otherwise you will ultimately fail. The committee concurred with the ability to move people around and that this would have a tremendous advantage to career growth and professional development. J.R. Thompson stated that the belief at the labs (e.g., DOE labs), is that acceptance of a civil servant position is a step back. The committee also referred to the mid-level personnel problem at Reston and the role of accepted service as an incentive. Cooper also commented that the view from the people who work with NASA is that something has to be done to improve the personnel flexibility and that the constraints of the procurement system are enormous. Cooper commented that it is important to get back to bringing in the best - not the lowest bidder. The committee concluded that leadership does not mean abdicating responsibility in non-leadership areas; but that you are pre-eminate enough that other nations want to join you.

#### **A More Effective Civil Space Program - The Center for Strategic and International Studies - Jim Morrison**

The last presentation to the C-FUSSP was a review of the Center for Strategic and International Studies (CSIS) Report on the goals of the U.S. Civil Space Program. Jim Morrison, Study Director for the report, presented the results of the study to the committee. Morrison began by an introduction of his background, specifically that he is currently a Vice President at BDM and an adjunct member of the CSIS. He stated that committee members Joe Allen, Jim Baker, and Dan Fink were members of the study group.

He told the committee that the CSIS study was undertaken to focus on the commercialization and the governmental organization aspects above NASA. Morrison stated that the SIG was viewed as a contradiction to a better space program. At the time of the study, they did not know that the NAS/NAE also had the intention of undertaking a similar study.

Morrison observed that the U.S. talks leadership, but plans, organizes, and funds for mediocrity. The tasks for the Steering Committee of the CSIS study were to review the rationale, environment, education, space science, and history of the space program. Morrison emphasized that there was no government money for the study and no serving government members on the committee; all meetings were private, off-the record and not for attribution. Morrison stated that the study suggests that a totally open activity impedes progress of such an effort.

Morrison stated that the report advised the new Administrator to strongly support education. Putting things in an historical perspective, Morrison stated that from the first flight of heavier than air to Armstrong's step on the Moon was 66 years. Another 66 years from 1969 brings you to the year 2035. The technology differential however, is an order of magnitude less than the first 66 years.

Morrison stated that by comparisons, during the same time frame, if you gauge government versus private industry technology development - we would never have gotten to the Moon with only the government. He sees that one of the candidate issues to consider is that NASA is a sub-unit of the U.S. government and that it is not an entity unto itself. Morrison considers multi-year funding as an integral issue. Morrison also stated that Congress does not trust NASA and he attributed this to the confusion between NASA and national objectives and the belief that NASA does not look out for American interests as a priority.

Morrison emphasized that the NASA vision needs to be broadened and that one means of doing so would be to get the NASA senior management into rotating positions for 18 months (6 month increments) with DOE, DoD, Congress, SII, etc. This would facilitate a broadening perception of the external environment.

Morrison also stated that the appropriate balance between the role of government and the private sector needs to be determined. He referred to page 24 of the CSIS report. He specifically mentioned private capital, investment in some embryonic industries, aeronautics, and the role of the commercial programs; the commercial area is not just an adjunct. Morrison stated that at the heart of the issue is the definition of an appropriate model for the future. He referred to the aeronautics model and the U.S. western frontier expansion era when an Army fort existed in the U.S. frontier to lower the risk of the westward-bound explorers and pioneers. Morrison asked what model should NASA follow? He stated that it is important that the goals and objectives correlate with the model (e.g., ELVs and Landsat.) He referred to the appropriateness of the planned activities with the model and asked if the U.S. government can fund an aggressive space program (Morrison referenced the Frosh paper.) He also stated that the role of the SSF had to be reconsidered in terms of the exploration goals. Morrison concluded that resilience is needed as well as clearly articulated goals and objectives, and a Congress that does not guide the press to damage NASA.

Following the presentation by Jim Morrison, the meeting adjourned.

## **Attachment 1**

September 14, 1990

**ADVISORY COMMITTEE ON THE FUTURE OF THE U.S. SPACE PROGRAM**

**AGENDA  
SEPTEMBER 13-15, 1990**

**Thursday, September 13**

8:00 Chairman Augustine Opening Remarks  
8:15 Mark Albrecht on National Space Policy  
9:15 Dick Truly Overview of NASA  
11:00 Len Fisk on Space Science and Applications  
12:00 Lunch  
1:00 Continuation of Len Fisk on Space Science and Applications  
2:00 Bill Lenoir on Space Flight  
5:00 Adjourn

**Friday, September 14**

8:00 Charles Force on Space Operations  
9:30 Arnie Aldrich on Exploration, NASP, and Technology  
11:30 Lunch  
1:00 Sam Keller on NASA Personnel and Institution  
3:00 Discussions between NASA Presenters and the Full Committee  
5:00 Adjourn

**Saturday, September 15**

8:30 Discussions of Future Perspectives of the U.S. Space Program Based on Selected Past Studies, to include:  
- "Pioneering the Space Frontier, Report of the National Commission on Space," Dr. Thomas O. Paine  
- "Leadership and America's Future in Space," Report to the Administrator (by Sally Ride), Alan Ladwig  
- "Toward a New Era in Space - Realigning Policies to New Realities," National Academy of Sciences / National Academy of Engineering, Dr. Robert S. Cooper  
- "A More Effective Civil Space Program - The Final Report of the CSIS Study of Civil Space Policy," James R. Morrison  
11:30 Adjourn

Meetings to be held at

**NASA Headquarters  
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Washington, D.C.**

## **Attachment 2**

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